



# The Institute of Navigation 2010 International Technical Meeting Plenary Session

Monday, January 25, 2010 • 9:00 a.m. – 12:00 p.m. • Kon Tiki Ballroom

## Welcome and Introductions



Dr. Mikel Miller  
**ION President**  
*Air Force Research  
Laboratory*



Patricia Doherty  
**ION General Chair**  
*Boston College*



Dr. Paul Kline  
**ION Program Chair**  
*Honeywell Aerospace*

## Plenary Session:

### Navigation Behind Closed Doors: Challenges of Indoor and Urban Positioning

The plenary will feature a series of invited talks addressing technological advances that enable navigation in areas where GPS signal strength is degraded. These talks will cover the current state of the technology, the remaining challenges, and the roadmap for the future. Current research will be presented on topics including first responders, aerial vehicles, and driver-assist technology.

**Are We There Yet? The State of the GNSS Market and Technology:** Dr. Frank van Diggelen, *Broadcom*

**Location and Tracking for First Responders:** Dr. R. James Duckworth, *Worcester Polytechnic Institute*; Dr. Jalal Mapar, *U.S. Department of Homeland Security*

**Expanding the Indoor Location Solution from GPS to Multiple Hybrid Technologies:** Mr. Greg Turetzky, *SiRF*

**Driver Assist System for Narrow Bus-only Shoulders:** Dr. Craig Shankwitz, *University of Minnesota*

**Positioning in Environments Where GPS Fails:** Dr. Binghao Li, *University of New South Wales, Australia*

**Assured Navigation of Ground and Aerial Vehicles in Urban Environments:** Dr. Maarten Uijt de Haag, *Ohio University*

## Technical Session Overview January 25–27, 2010 San Diego, CA

Mon. Morning 9:00 a.m.–12:00 p.m.	Mon. Afternoon 2:00 p.m.–5:30 p.m.	Tues. Morning 8:30 a.m.–12:00 p.m.	Tues. Afternoon 2:00 p.m.–5:30 p.m.	Wed. Morning 8:30 a.m.–12:00 p.m.	Wed. Afternoon 1:00 p.m.–4:10 p.m.
Kon Tiki Ballroom <b>Plenary Session</b>	Boardroom <b>A1:</b> Inertial Navigation	Toucan <b>A2:</b> Multisensor Navigation	Boardroom <b>A3:</b> Alternative Sensors & Emerging Navigation Technologies	Toucan <b>A4:</b> Urban & Indoor Navigation Technology I	Toucan <b>A5:</b> Urban & Indoor Navigation Technology II
	Cockatoo <b>B1:</b> Aviation Applications	Kon Tiki Ballroom <b>B2:</b> GBAS/SBAS	Toucan <b>B3:</b> Atmospheric Effects & Space Weather	Cockatoo <b>B4:</b> Marine Based Applications	Boardroom <b>B5:</b> Space Based Applications & Remote Sensing
	Toucan <b>C1:</b> Carrier Phase Based Positioning	Cockatoo <b>C2:</b> Receiver & Antenna Technology I	Cockatoo <b>C3:</b> Receiver & Antenna Technology II	Kon Tiki Ballroom <b>C4:</b> Algorithms & Methods I	1:00 p.m.–2:35 p.m. Kon Tiki Ballroom <b>C5a:</b> Algorithms & Methods II 2:35 p.m.–4:10 p.m. Kon Tiki Ballroom <b>C5b:</b> Land Based Applications
	Kon Tiki Ballroom <b>D1:</b> GNSS Modernization	Boardroom <b>D2:</b> Interference & Spectrum Management	Kon Tiki Ballroom <b>D3:</b> GNSS Accuracy, Integrity, Continuity & Availability	Boardroom <b>D4:</b> GNSS Simulation & Testing	Cockatoo <b>D5:</b> Galileo & GPS/Galileo
12:00 p.m. – 1:00 p.m. <b>Informal Luncheon</b> On the Beach, Bayside North (if inclement weather, Rousseau Suite (1st floor))			<b>ION Annual Awards &amp; Fellows Banquet</b> Toucan/Macaw 6:30 p.m. – 7:00 p.m. Cash Bar 7:00 p.m. – 9:00 p.m. Dinner & Program Dessert compliments of <b>NORTHROP GRUMMAN</b>	12:00 p.m. – 1:00 p.m. <b>Informal Luncheon</b> On the Beach, Bayside North (if inclement weather, Rousseau Suite (1st floor))	

**Note that the photographing of sessions/presentations and/or the audio or video recording of sessions/presentations is prohibited. As a courtesy to others, please set all cell phones to vibrate.**

# Monday Afternoon, January 25



Dr. Thomas Pany,  
IFEN GmbH,  
Germany



Dr. Jussi  
Collin, Tampere  
University of  
Technology,  
Finland



Kathleen Boseley,  
Northrop  
Grumman



Dr. Sai  
Kalyanaraman,  
Rockwell Collins

## Session A1: Inertial Navigation

2:00 p.m. – 5:30 p.m., Boardroom

- 2:05 1. A Low Cost INS/GPS Solution Comparison for Automotive Mass Market Applications: M. Rao, *Università degli Studi di Palermo, Italy*; S. Savasta, *Politecnico di Torino, Italy*; E. Falletti, F. Dominici, G. Marucco, A. Defina, *Istituto Superiore Mario Boella, Italy*
- 2:35 2. Real Time Implementation of a Non-coherent Deeply Coupled GPS/INS System: S. Kiesel, M. Langer, G.F. Trommer, *University of Karlsruhe, Germany*
- 3:05 3. Implementation and Performance Evaluation of Low-Cost MEMS based GPS RTK/IMU Integration System for Urban Area Navigation: J-H. Song, K-H. Kim, G-In. Jee, *Konkuk University, South Korea*

Break 3:35 p.m. – 3:55 p.m.

- 4:00 4. Development of an Adaptive Unscented Particle Filter for Tightly-coupled MEMS-INS/GPS Integrated Navigation System: J. Zhou, S. Knedlik, O. Loffeld, *University of Siegen, Center for Sensorsystems (ZESS), Germany*
- 4:30 5. The Effect of Time Synchronization on Real Time Implementation of GPS/INS Integration Systems: A. Moussa, A. Ali, N. El-Sheimy, *University of Calgary, Canada*
- 5:00 6. Accurate Pipeline Surveying Using Two-Filter Optimal Smoothing of Inertial Navigation Data Augmented with Velocity and Coordinate Updates: H. Liu, S. Nassar, N. El-Sheimy, *University of Calgary, Canada*

### Alternates

1. Allan Variance Analysis of the H764G Stochastic Sensor Model and its Application in Land Vehicle Navigation: L. Li, Y. Pan, *Cbongqing University, China*; D. Grejner-Brzezinska, C. Toth, H. Sun, *The Ohio State University*
2. An Inertial Navigation System for Autonomous Outdoor Robots: M. Jew, A. El-Osery, *New Mexico Tech*; S. Bruder, *Applied Technology Associates*
3. In Field Calibration of Three-Axis Magnetometers: J. Cai, N.L. Andersen, C. Malureanu, *Southern Denmark University, Denmark*

## Session B1: Aviation Applications

2:00 p.m. – 5:30 p.m., Cockatoo

- 2:05 1. Gravity Gradiometry and Map Matching: An Aid to Aircraft Inertial Navigation Systems: A. DeGregoria, *Air Force Institute of Technology*
- 2:35 2. Carrier-phase Position Domain Smoothing (CPDS) Algorithm and Flight Test Results for New Dual-Frequency Differential Architecture: D. Bruckner, F. van Graas, T. Skidmore, *Ohio University*
- 3:05 3. Online Atmosphere Monitoring Concept with ATC Interface: T. Feuerle, M. Stanisak, M. Steen, P. Hecker, *Technische Universität Braunschweig, Germany*

Break 3:35 p.m. – 3:55 p.m.

- 4:00 4. Preliminary Assessment of Alternative Navigation Means for Civil Aviation: S. Lo, P. Enge, *Stanford University*; F. Niles, *The MITRE Corporation*; R. Loh, *Innovative Systems International*; L. Eldredge, M. Narins, *Federal Aviation Administration*
- 4:30 5. ADS-B Data Evaluation by the Trial Project in Western China: W. Liu, Y. Zhu, J. Zhang, Y. Wang, *Aviation Data Communication Corporation, China*
- 5:00 6. Impact of Constellation Health on ADS-B Service Availability: M. Harris, T. Murphy, D. Miller, *Boeing*

### Alternates

1. Design and Flight Test of Flight Control System for a Small Endurance UAV Only Using 4Hz Single-Antenna GPS Receiver: A. Cho, J. Kim, H. No, C. Kee, *Seoul National University, South Korea*; S. Koo, *Korea Aerospace Research Institute, South Korea*
2. Prediction of WAM Performance - Development of a Software Tool and Validation of Applicable Algorithms: A. Jasch, T. Feuerle, A. Ronnenberg, P. Hecker, *TU Braunschweig, Germany*

# Monday Afternoon, January 25



Patrick Henkel,  
Technical  
University of  
Munich, Germany



Dr. Sandra  
Verhagen, Delft  
University of  
Technology,  
The Netherlands

## Session C1: Carrier Phase Based Positioning

2:00 p.m. – 5:30 p.m., Toucan

- 2:05 1. Reducing the Time-To-Fix for Stand-Alone Single-Frequency GNSS Attitude Determination: G. Giorgi, *Delft University of Technology, The Netherlands*; P.J.G. Teunissen, *Curtin University of Technology, Australia/Delft University of Technology, The Netherlands*; S. Verhagen, *Delft University of Technology, The Netherlands*
- 2:35 2. Improved Ambiguity Resolution with a C-band Signal: R.R. Hatch, *NavCom Technology, Inc.*; S. Verhagen, *Delft University of Technology, The Netherlands*
- 3:05 3. GPS/GIOVE Integrated Precise Point Positioning Performance Evaluation: W. Cao, *University of New Brunswick, Canada*; A. Hauschild, *German Space Operations Center, Germany*; P. Steigenberger, *Technical University of Munich, Germany*; R.B. Langley, M. Santos, *University of New Brunswick, Canada*; O. Montenbruck, *German Space Operation Center, Germany*

Break 3:35 p.m. – 3:55 p.m.

- 4:00 4. Implementation and Experimental Validation of Cycle Ambiguity Resolution with Position Domain Integrity Risk Constraints: S. Khanafseh, B. Pervan, *Illinois Institute of Technology*
- 4:30 5. LAMBDA-Based Ambiguity Resolution for Next-Generation GNSS Wide-Area RTK: D. Odiik, *Curtin University of Technology, Australia*; S. Verhagen, *Delft University of Technology, The Netherlands*; P.J.G. Teunissen, *Curtin University of Technology, Australia/Delft University of Technology, The Netherlands*; M. Hernandez-Pajares, J.M. Juan, J. Sanz, *Technical University of Catalonia, Spain*; J. Samsón, M. Tossaint, *ESA/ESTEC, The Netherlands*
- 5:00 6. High Integrity Carrier Phase Based Relative Positioning for Precision Landing using a Robust Nonlinear Filter: M. Rippl, *German Aerospace Center (DLR), Germany*; S. Schlötzer, *EADS Astrium, Germany*; P. Henkel, *Technical University of Munich, Germany*

Alternate

1. Reliability of Ambiguity Resolution Using GPS and GLONASS: R.B. Ong, M.G. Petovello, G. Lachapelle, *University of Calgary, Canada*

## Session D1: GNSS Modernization

2:00 p.m. – 5:30 p.m., Kon Tiki Ballroom

- 2:05 1. Proving the Walk Matches the Talk - Verification of GPS Performance Assertions: J.W. Lavrakas, *Advanced Research Corporation*; B.A. Renfro, *University of Texas Applied Research Laboratories*
- 2:35 2. On the Power Spectral Density of GNSS Signals, with Applications: J.W. Betz, *The MITRE Corporation*
- 3:05 3. Future Navigation Satellite System Architectures: Inter-Satellite Ranging and Orbit Determination: A. Fernández, M. Sánchez, *DEIMOS Space, Spain*; T. Beck, *Astrium GmbH, Germany*; F. Amarillo, *ESA-ESTEC, Netherlands*

Break 3:35 p.m. – 3:55 p.m.

- 4:00 4. Analysis and Implementation of Interplex Modulation Technique for IRNSS Composite Signal: P. Patidar, J.K. Hota, A.K. Sisodia, *Navigation Systems Development Division, India*
- 4:30 5. Receiver Compatibility of POCET Signal Combining: P.A. Dafesh, R. Bow, T. Fan, J. Hsu, *The Aerospace Corporation*
- 5:00 6. GPS L1C: Enhanced Performance, Receiver Design Suggestions, and Key Contributions: T. Stansell, *Stansell Consulting*; K. Hudnut, *USGS*; R. Keegan, *Integrated Positioning, LLC*

Alternates

1. Current and Future GNSS Message Performance Based on Real Signal Processing in Urban Environment: S. Corazza, J.L. Damidaux, G. Buscarlet, *Thales Alenia Space, France*; L. Ries, *CINES, France*
2. New Concept for the On-Board Master Clock Generation Unit for Future Galileo Satellites: F. Soualle, *Astrium GmbH, Germany*; F. Amarillo Fernandez, *ESTEC, The Netherlands*; T. Beck, H. Trautenberg, J. Wendel, L. Stopfkuchen, D. Felbach, *Astrium GmbH, Germany*; M. Sánchez Nogales, *DEIMOS, Spain*



Col. David  
Goldstein, U.S.  
Air Force GPS  
Wing



Dr. Thomas  
Powell, The  
Aerospace  
Corporation



Dr. Dorota Grejner-Brzezinska,  
*The Ohio State University*



Dr. Andrey Soloviev,  
*University of Florida*



Matt Harris,  
*Boeing*



Dr. Félix Torán,  
*European Space Agency, France*

## Session A2: Multisensor Navigation

**8:30 a.m. – 12:00 p.m., Toucan**

- 8:35 1. Comparison of Centralized and Decentralized Kalman Filter for SAR/TRN/GPS/INS Integration: A. Maier, G.F. Trommer, *KIT - Institute of Systems Optimization, Germany*
- 9:05 2. Introduction to Newtonian Estimation and IMU Modeling: C. Shapiro, *Independent Consultant*
- 9:35 3. Foot-Mounted Inertial Navigation and Cooperative Sensor Fusion for Indoor Positioning: J. Rantakokko, P. Strömbäck, S-L. Wirkander, *Swedish Defence Research Agency, Sweden*; I. Skog, P. Händel, *Signal Processing Lab, Royal Institute of Technology, KTH*; M. Alexandersson, K. Fors, *Swedish Defence Research Agency, Sweden*

**Break 10:05 a.m. – 10:25 a.m.**

- 10:30 4. Sensor Modeling and Sensitivity Analysis for Next Generation Time-Space Position Information (TSPI) System: M. Smearcheck, M. Veth, *Air Force Institute of Technology*
- 11:00 5. Bayesian Terrain-aided Inertial Navigation using Airborne Laser Scanner: N. El Baraka, *Thales Communications, France*; F. Le Gland, *INRIA Rennes and IRISA, France*
- 11:30 6. A Feasibility Study for Multi-agent Beamforming without GPS: C.N. Taylor, *Brigham Young University*; M. Miller, *Air Force Research Laboratory*

### Alternates

1. Context Awareness for GPS-Enabled Phones: J. Kantola, *Tampere University of Technology, Finland*; M. Perttunen, T. Leppanen, *University of Oulu, Finland*; J. Collin, *Tampere University of Technology, Finland*; J. Riekkö, *University of Oulu, Finland*
2. Relative Localisation of Mobile Robotic Platform Based on Inertial Navigation System and Enhanced Odometry: M. Andrzejczak, J. Głowska, A. Wószczuk, T. Rokosz, M. Koziski, *PIAP, Poland*

## Session B2: GBAS/SBAS

**8:30 a.m. – 12:00 p.m., Kon Tiki Ballroom**

- 8:35 1. Coverage Improvement for Dual Frequency SBAS: T. Walter, J. Blanch, P. Enge, *Stanford University*
- 9:05 2. Recent Development of QZSS L1-SAIF Master Station: T. Sakai, S. Fukushima, K. Ito, *Electronic Navigation Research Institute, Japan*
- 9:35 3. Availability of GAST D GBAS Considering Continuity of Airborne Monitors: C.A. Shively, T.T. Hsiao, *MITRE/CAASD*
- 10:30 4. Implications of 30-Second Smoothing for GBAS Approach Service Type D: T. Murphy, M. Harris, *Boeing*; S. Beauchamp, *Federal Aviation Administration William J Hughes Technical Center*

**Break 10:05 a.m. – 10:25 a.m.**

- 11:00 5. GBAS/INS Navigation System: Further Developments of On-Board Integrity Monitoring: M. Steen, P. Hecker, *Institute of Flight Guidance, Technical University Braunschweig, Germany*
- 11:30 6. GBAS Differentially Corrected Positioning Service Ionospheric Anomaly Errors Evaluated in an Operational Context: T. Murphy, M. Harris, *Boeing*; Y.S. Park, S. Pullen, *Stanford University*

### Alternates

1. Analysis of Maritime DGPS Malfunction by the Satellite Failure on PRN23: S-H. Park, K.Y. Seo, D.J. Cho, S.H. Suh, *GNSS Research Center, Korea Ocean R&D Institute, South Korea*
2. Analysis of Phase Trellis Overlay Modulations for a DGPS Secondary Communications Channel: R.J. Hartnett, *U.S. Coast Guard Academy*; P.F. Swaszek, *University of Rhode Island*; K.C. Gross, *U.S. Coast Guard Academy*

**Lunch is on Your Own**

# Tuesday Morning, January 26

## Session C2: Receiver and Antenna Technology I

8:30 a.m. – 12:00 p.m., Cockatoo

- 8:35 1. Design Technique for Precise GNSS Receiver Post-Correlation Noise Floor Measurements with Usage Design Examples by the Search and Tracking Processes: P.W. Ward, *Navward GPS Consulting*
- 9:05 2. Optimized and Approximated Position/Velocity Signal Processing for Vector Tracking Techniques: S-H. Im, G-I. Jee, *Konkuk University, South Korea*
- 9:35 3. Robust GNSS Signal Tracking Against Scintillation Effects: A Particle Filter Based Software Receiver Approach: Y-H. Chen, J-C. Juang, T-L. Kao, *National Cheng Kung University, Taiwan*

**Break 10:05 a.m. – 10:25 a.m.**

- 10:30 4. Joint Satellite Code and Carrier Tracking: K. Giger, P. Henkel, *Technical University of Munich, Germany*; C. Guenther, *German Aerospace Center (DLR), Germany*
- 11:00 5. Space-Time Adaptive Processing for Mitigation of Platform Generated Multipath: A. O'Brien, I.J. Gupta, *The Ohio State University*; C.J. Reddy, *Applied EM Frederick*; S. Werrell, *NAVAIR*
- 11:30 6. Cognitive Antijam Receiver System (CARS) for GNSS: P. Dafesh, R. Prabhu, *The Aerospace Corporation*

Alternate

1. A USRP-Based Testbed for Navigation Education, Research, and Development: G.C. Wyman, P.F. Swaszek, *University of Rhode Island*; R. Hartnett, *United States Coast Guard Academy*

## Session D2: Interference & Spectrum Management

8:30 a.m. – 12:00 p.m., Boardroom

- 8:35 1. Modeling Distributions of Non-Coherent Integration Sidelobes: J.J. Rushanan, D.W. Winters, *The MITRE Corporation*
- 9:05 2. Analysis of Cross Correlation on Code Tracking and Mitigation Techniques using Advanced Correlator: Y. Tian, F. Liu, T. Zeng, L. Zhang, *Radar Research Laboratory, Beijing Institute of Technology, China*
- 9:35 3. A Method of DOA Estimation Based on Wavelet Transform: Z-R. Wang, G-Y. Ma, *The National Astronomical Observatories, China*

**Break 10:05 a.m. – 10:25 a.m.**

- 10:30 4. Interference Localization in the GPS L1 Band: O. Isoz, *Luleå University of Technology, Sweden*; A. Tabatabaei, *University of New South Wales, Australia*; D. Akos, *Luleå University of Technology, Sweden*
- 11:00 5. Extended Theory of Spectral Separation Coefficient for GNSS Signal Interference: T. Shibata, *Copla Co., Ltd., Japan*; H. Maeda, *Lighthouse Technology and Consulting Co., Ltd., Japan*
- 11:30 6. Codes Cross-Correlation Impact on the Interference Vulnerability of Galileo E1 OS and GPS L1C Signals: D. Margaria, S. Savasta, F. Dosis, *Politecnico di Torino, Italy*; B. Motella, *Istituto Superiore Mario Boella, Italy*

Alternate

1. Self-Turning Synthesis Filter for GNSS Antenna Array with Mutual Coupling and Interference: C-L. Chang, *National Pingtung University of Science and Technology, Taiwan*



Dr. Dan Aloï,  
*Oakland University*



Waldemar  
Kunysz, *NovAtel Inc., Canada*



Dr. Jade Morton,  
*Miami University*



Andrew O'Brien,  
*The Ohio State University*

# Tuesday Afternoon, January 26



Dr. Gert Trommer,  
University of  
Karlsruhe,  
Germany



Dr. Sara Susca,  
Honeywell  
International

## Session A3: Alternative Sensors and Emerging Navigation Technologies

2:00 p.m.— 5:30 p.m., Boardroom

- 2:05 1. The Impact of Attitude on Image-Based Integrity: C. Larson, J. Raquet, *Air Force Institute of Technology*
- 2:35 2. Camera-based Navigation, Mapping and 3D Model Generation for Indoor Environments: J. Rydell, T. Andersson, *Swedish Defence Research Agency, Sweden*
- 3:05 3. Simulation Study of UWB-OFDM SAR for Dead-Reckoning Navigation: K. Kauffman, J. Raquet, Y. Morton, D. Garmatyuk, *Air Force Agency of Technology*

**Break 3:35 p.m. – 3:55 p.m.**

- 4:00 4. High-Precision Narrow-Band RF Ranging: B. Farnsworth, D.W.A. Taylor, *ENSCO, Inc.*
- 4:30 5. Motion Estimation and Navigational Drift Correction with LIDAR Data: R.A. Balabail, K.B. Ariyur, *Purdue University*
- 5:00 6. Weak eLoran Signal Acquisition Using Correlation-based Hybrid Coherent/Non-coherent Integration: J-H. Im, S-H. Im, G-I. Jee, *Konkuk University, South Korea*

**Alternates**

1. Designing, Developing, and Deploying a Small Footprint eLoran System: C. Schue, *UrsaNav, Inc.*
2. High-accuracy All Silicon MEMS Gyrochip for 4 in3 Gyrometer Package: O. Mezentsev, E. Frolov, M. Klimkin, D. Soloviev, A. Mezentsev, *iSense LLC, Russia*
3. Algorithms to Identify its Own and Surrounding Tunnels for an Underground Mine Tracking Device: J. Li, R. Unger, *The National Institute for Occupational Safety and Health*

## Session B3: Atmospheric Effects & Space Weather

2:00 p.m.— 5:30 p.m., Toucan

- 2:05 1. GPS Signal Propagation Mode Impact on Receiver Position Errors: Y. Morton, *Miami University*; R. Moore, *University of Florida*; E. van Graas, *Ohio University*
- 2:35 2. The Effects of Solar/Geomagnetic Storms on RadCal Ephemeris Solutions: J.T. Saffell, C.F. Minter, S.P. Simmons, J.W. Stevens, *National Geospatial-Intelligence Agency*
- 3:05 3. First Look at In-Flight Rosa Performance on Board Oceansat-2: A. Zin, S. Landenna, L. Marradi, L. Scaciga, S. Zago, E. Mangolini, *Thales Alenia Space - Italia, Italy*; F. Vespe, V. DeCosmo, *ASI, Agenzia Spaziale Italiana - Viale Liegi, Italy*

**Break 3:35 p.m. – 3:55 p.m.**

- 4:00 4. Ionospheric Imaging using Multiple GNSS Constellations: O. al-Fanek, S. Skone, *University of Calgary, Canada*
- 4:30 5. Regional Distributions of TEC Values Measured in South America: C.E. Valladares, P. Doherty, *Boston College/Inst. for Scientific Research*
- 5:00 6. Using GPS to Measure the Effect of Stratospheric Warmings on the Ionosphere: A. Coster, L. Goncharenko, *MIT Haystack Observatory*; T. Tsugawa, *National Institute of Information and Communications Technology, Japan*; J. Chau, *Jicamarca Observatory, Peru*; C. Valladares, *Institute for Scientific Research, Boston College*

**Alternates**

1. Mid-Latitude Ionospheric Irregularities Persisting Into Late Morning During the Magnetic Storm on 19 March 2001: G. Ma, J. Li, Takashi, *National Astronomical Observatories, Chinese Academy of Sciences, China*; T. Maruyama, *National Institute of Information and Communications Technology, Japan*
2. Prediction of Ionospheric Delay using Modified Klobuchar Coefficients for Indian Regional Navigation System: A.K. Shukla, S. Das, A.P. Shukla, V.S. Palsule, *Space Applications Centre, ISRO, India*

**ION Annual Awards & Fellows Banquet, 6:30 p.m. -9:00 p.m., Toucan/Macaw**

**Dessert compliments of *NORTHROP GRUMMAN***



Dr. Anthea  
Coster, MIT  
Haystack  
Observatory



Patricia Doherty,  
Boston College

# Tuesday Afternoon, January 26



Dr. Dan Aloi,  
Oakland  
University



Waldemar  
Kunysz, *NovAteI  
Inc., Canada*



Dr. Young Lee,  
The MITRE  
Corporation



Karl Kovach,  
The Aerospace  
Corporation

## Session C3: Receiver and Antenna Technology II

2:00 p.m. – 5:30 p.m., Cockatoo

2:05 1. Co-Processor Aiding for Real-Time Software GNSS Receiver: A. Knezevic, *University of Calgary, Canada*

2:35 2. A Multifrequency Low-Cost Architecture for GNSS Software Receivers: D. Cristaldi, D. Margaria, L. Lo Presti, *Politecnico di Torino, Italy*

3:05 3. Multi-band GNSS Front-end Architecture Suitable for Integrated Circuits: A. Rügamer, S. Urquijo, G. Rohmer, *Fraunhofer Institute for Integrated Circuits IIS, Germany*

**Break 3:35 p.m. – 3:55 p.m.**

4:00 4. An In-Line Anti-Spoofing Module for Legacy GPS Civil Receivers: B.M. Ledvina, W.J. Bencze, *Coherent Navigation, Inc.*; T. Humphreys, *University of Texas at Austin*

4:30 5. Development of Real-Time Software GPS Receiver using Windows Visual C++ and USB RF Front-end: S. Jeon, H. So, H. No, T. Lee, C. Kee, *Seoul National University, South Korea*

5:00 6. A Framework for Real-time GNSS Software Receiver Research: D.A. Godsoe, M.E. Kaye, R.B. Langley, *University of New Brunswick, Canada*

Alternate

1. Adaptive Data/Pilot Carrier Phase Tracking for Modernized GNSS Signals: K. Muthuraman, D. Borio, *University of Calgary, Canada*; R. Klukas, *University of British Columbia Okanagan, Canada*; G. Lachapelle, *University of Calgary, Canada*

## Session D3: GNSS Accuracy, Integrity, Continuity, and Availability

2:00 p.m. – 5:30 p.m., Kon Tiki Ballroom

2:05 1. Navstar Satellite SVN-49: K. Kovach, T. Powell, *The Aerospace Corporation*

2:35 2. Characterization and Simulation of SVN49 (PRN01) Elevation Dependent Measurement Biases: S. Ericson, *Zeta Associates Incorporated*; K. Shallberg, *Grass Roots Enterprises Inc.*; C. Edgar, *The Aerospace Corporation*

3:05 3. Analysis of Hypothetical GPS IIIC Integrity for LPV 200 Operations: C.A. Shively, *MITRE/CAASD*

**Break 3:35 p.m. – 3:55 p.m.**

4:00 4. Probabilistic Satellite Selection for Use with Multiple Constellations in Modernized GNSS: S. Pullen, P. Enge, *Stanford University*

4:30 5. On-Board Signal Monitoring Unit for Future Galileo Satellites: F. Soualle, *Astrium GmbH, Germany*; F. Amarillo Fernandez, *ESTEC, The Netherlands*; T. Beck, H. Trautenberg, L. Stopfkuchen, D. Felbach, *Astrium GmbH, Germany*; M. Sanchez Nogales, *DEIMOS, Spain*

5:00 6. Mitigation of Anomalous Ionospheric Threats using Hysteresis RAIM: C. Mayer, *German Aerospace Center, Germany*; J. Blanch, *Stanford University*

Alternates

1. GPS Ephemeris Error Screening and Results for 2006/2009: L. Heng, G.X. Gao, T. Walter, P. Enge, *Stanford University*

2. Future Satellite Navigation System Architecture - System Performance: T. Beck, *Astrium GmbH, Germany*; H. Trautenberg, *EADS Astrium GmbH, Germany*; A. Fernandez, *DEIMOS Space S.L., Spain*; P. Poirier, L. Montoya, *EADS Astrium, Germany*; L. Greda, A. Konovaltsev, J. Hammesfahr, *German Aerospace Center DLR, Germany*

ION Annual Awards & Fellows Banquet, 6:30 p.m. -9:00 p.m., Toucan/Macaw

Dessert compliments of **NORTHROP GRUMMAN**

# Wednesday Morning, January 27



Dr. R. James Duckworth,  
Worcester  
Polytechnic  
Institute



Dr. Jalal Mapar,  
Department  
of Homeland  
Security



Capt. Richard  
Hartnett, U.S.  
Coast Guard  
Academy



Gunnar  
Mangs, SAAB  
TransponderTech  
AB, Sweden

## Session A4: Urban & Indoor Navigation Technology I

8:30 a.m. – 12:00 p.m., Toucan

- 8:35 1. GPS-Denied Pedestrian Tracking in Indoor Environments Using an IMU and Magnetic Compass: W.T. Faulkner, R. Alwood, D.W.A. Taylor, J. Bohlin, *ENSCO, Inc.*
- 9:05 2. Location Determination Using Integrated LIDAR Data: S. Susca, R. Hartman, *Honeywell International*
- 9:35 3. WPI Precision Personnel Locator System – Rapid Deployment Antenna System and Supporting Algorithms for 3D Precision Location: A. Cavanaugh, M. Lowe, D. Cyganski, J. Duckworth, *Worcester Polytechnic Institute*

Break 10:05 a.m. – 10:25 a.m.

- 10:00 4. Improved Pedestrian Navigation Based on Drift-Reduced MEMS IMU Chip: E. Foxlin, S. Wan, *InterSense Incorporated*
- 10:30 5. Pedestrian Indoor Navigation Algorithm based on the Pseudolite and Low-cost IMU with Magnetometers Including In-Flight Calibration: T. Lee, C. Kim, *Seoul National University, South Korea*; S. Jeon, *Korea Telecom, South Korea*; S. Jeon, G. Kim, C. Kee, *Seoul National University, South Korea*
- 11:00 6. Wi-Fi Assisted Multi-sensor Personal Navigation System for Indoor Environments: X. Zhao, *University of Calgary, Canada*; C. Goodall, Z. Syed, *Trusted Positioning Inc., Canada*; B. Wright, N. El-Sheimy, *University of Calgary, Canada*

Alternate

1. Straight-Line Walking and Path-Turn Identifying Algorithms for Tracking Devices in Underground Mines: J. Li, *The National Institute for Occupational Safety and Health*

## Session B4: Marine Based Applications

8:30 a.m. – 12:00 p.m., Cockatoo

- 8:35 1. Underwater Mapping and Navigation: Applications of 3D Feature Extraction Algorithms to 3D Sonar Datasets: J.N. Markiel, D. Grejner-Brzezinska, *The Ohio State University*; C. Toth, *Center for Mapping*; W. Woodward, J. Moore, *UrsaNav*
- 9:05 2. Exploring a GPS Inspired Acquisition and Tracking Concept for Terrain Referenced Navigation: D. Vaman, *Technical University Delft, The Netherlands*; P. Oonincx, *Netherlands Defense Academy, The Netherlands*; E. Theunissen, *Technical University Delft, The Netherlands*
- 9:35 3. Field Testing of GPS Applications in Ship-to-Ship Lightering Operations: E. Pedersen, D. Husjord, Y. Yoo, *Norwegian University of Science and Technology, Norway*; E. Shimizu, *Tokyo University of Marine Science and Technology, Japan*

Break 10:05 a.m. – 10:25 a.m.

- 10:00 4. Simple Loran Cycle Error Detection Algorithms for Maritime Harbor Entrance Approach Operations: B. Peterson, S. Lo, P. Enge, *Stanford University*
- 10:30 5. The Research of Dredger's Loading Conditions Monitoring System: G-J. Peng, J-H. Chen, Y-Z. Weng, *Navigation Institute of Jimei University, China*
- 11:00 6. Three Dimensional Sonar Mission Package for Mine Detection and Classification, IED Detection and Classification, and Port and Harbor Surveillance: W.R. Woodward, R. Webb, *UrsaNav*; R. Kahrs Hansen, *CodaOctopus Omnitech AS, Norway*; B. Cunningham, *CodaOctopus Research and Development Ltd., UK*

Alternate

1. Design and Realization of No. 1 Zheng He Pilot Navigation Platform: G.J. Peng, R.X. Ke, X.G. Zhang, *Navigation Institute of Jimei University, China*

# Wednesday Morning, January 27



Dr. Letizia  
Lo Presti,  
Politecnico di  
Torino, Italy



Dr. José-Ángel  
Ávila-Rodríguez,  
University FAF  
Munich, Germany



Peter Boulton,  
Spirent  
Communications  
plc, UK



Dr. Alexander  
Mitelman, CSR,  
Sweden

## Session C4: Algorithms & Methods I

### 8:30 a.m. – 12:00 p.m., Kon Tiki Ballroom

- 8:35 1. Generalized Binary Coded Symbol Modulation Theoretical Performance with Multipath and Noise: J. Spilker, Jr., *Stanford University*
- 9:05 2. GPS L5 Signal Acquisition Exploiting Neumann-Hoffman Code Transitions: M. Pini, *Istituto Superiore Mario Boella, Italy*; L. Lo Presti, E. Viviani, *Politecnico di Torino, Italy*
- 9:35 3. Enhanced Bayesian Detection for Weak GPS and Galileo Signal Acquisition: L. Lo Presti, *Politecnico di Torino, Italy*; M. Fantino, *Istituto Superiore Mario Boella, Italy*; M. Nicola, *Politecnico di Torino, Italy*

### Break 10:05 a.m. – 10:25 a.m.

- 10:00 4. Mitigation of the Code-carrier Divergence Effect on Single Frequency user Receivers for Enhanced Availability and Accuracy under Ionospheric Degraded Conditions: J.I. Caudepón Amenabar, T.B. Santos, E. Sardón Pérez, *GMV Aerospace and Defence S.A., Spain*
- 10:30 5. A Two Phase Genetic Algorithm Based Wireless Network Localization Technique: T. Abdelazim, A. El-Sayed, A. Ali, *University of Calgary, Canada*
- 11:00 6. Requirements and Analysis of The Robust CBOC Tracking Algorithm in the Scope of the GAMMA-A Project: A. Jovanovic, *EPFL, Switzerland*; C. Mongredien, *Fraunhofer IIS, Germany*; C. Botteron, *EPFL, Switzerland*; G. Rohmer, *Fraunhofer IIS, Germany*

## Session D4: GNSS Simulation & Testing

### 8:30 a.m. – 12:00 p.m., Boardroom

- 8:35 1. Semi-Analytic Simulations: An Extension to Unambiguous BOC Tracking: D. Borio, P.B. Anantharamu, G. Lachapelle, *University of Calgary, Canada*
- 9:05 2. Testing GPS Receiver Performance under Pedestrian Movements: D. Karunanayake, *GPS SW & System Validation*
- 9:35 3. Experiment with Truncated P-code Signal: J. Li, G. Ma, J. Fan, *National Astronomical Observatories, Chinese Academy of Sciences, China*

### Break 10:05 a.m. – 10:25 a.m.

- 10:00 4. Architecture and Implementation of a Universal Real-Time GNSS Signal Simulator: R. Li, D. Zeng, T. Long, L. Zhang, *Beijing Institute of Technology, China*
- 10:30 5. A Study on Combined GPS/GLONASS RTK Receiver using Embedded Platform and Field Test Results in Urban Area: B-H. Lee, G-I. Jee, *Konkuk University, South Korea*
- 11:00 6. Algorithm and Realization of High Dynamic Satellite Signal Doppler Simulation Based On FPGA: Y. Song, H. Zhou, T. Zeng, L. Zhang, *Beijing Institute of Technology, China*

### Alternate

1. Simulation of the GPS SV49 Signal Anomaly: P.G. Crampton, *Spirent Federal Systems, USA*; P. Boulton, *Spirent Communications, UK*; T. Stansell, G. Fay, *The Aerospace Corporation*

# Wednesday Afternoon, January 27



Dr. R. James Duckworth,  
Worcester  
Polytechnic  
Institute



Dr. Jalal Mapar,  
Department  
of Homeland  
Security

## Session A5: Urban & Indoor Navigation Technology II

1:00 p.m.– 4:10 p.m., Toucan

- 1:05 1. Your Personal Navigator in Your Pocket; A Solution to Accurate, Hands-free, Pedestrian Navigation: B. Nair, A. Christie, *Sarantel Ltd., UK*
- 1:35 2. Development of an Integrated IMU, Image Recognition and Orientation Sensor for Pedestrian Navigation: C. Hide, *University of Nottingham, UK*; T. Botterill, *Geospatial Research Centre, New Zealand*
- 2:05 3. Indoor Navigation and Multipath Mitigation Using Code-Offset Based Pseudolite Transmitter Array: S-H. Im, G-I. Jee, *Konkuk University, South Korea*
- 2:40 4. A Positioning System Using Chinese Digital TV Signals Under Limited GPS Signal Observability Conditions in Urban Environment: W. Li, H. Wu, *Nankai University, China*; D. Ucci, Y. Morton, *Miami University*
- 3:10 5. Indoor Vision-Aided Inertial Navigation for an Autonomous Rotorcraft Vehicle: C.L. Bottasso, D. Leonello, *Aerospace Department, Politecnico Milano, Italy*
- 3:40 6. Characterisation and Modelling of the Indoor Pseudorange Error Using Low Cost Receivers: T. Jost, M. Khider, M.E. Abdo Sánchez, *DLR Institute of Communications and Navigation, Germany*

Alternate

1. A Real-time Human Tracking System with Fall Detection Capability: N. Parnian, P. Taghipour Bibalan, A. Marzouk, F. Golnaraghi, *Simon Fraser University, Canada*

## Session B5: Space Based Applications & Remote Sensing

1:00 p.m.– 4:10 p.m., Boardroom

- 1:05 1. Functional and Performance Validation of the PRISMA Precise Orbit Determination Facility: J-S. Ardaens, O. Montenbruck, S. D'Amico, *German Space Operations Center (DLR/GSOC), Germany*
- 1:35 2. Maiden Flight Results of Navigator GPS Receiver on HST-SM4: G.W. Heckler, L. Winternitz, *NASA Goddard Space Flight Center*; W. Bamford, *Emergent Space Technologies*; M. Walker, *Purdue University*
- 2:05 3. The GReS Research Project: A GPS/Galileo Receiver for Space Applications: A. Di Cintio, A. Caliumi, D. Della Ratta, M. Esposito Montefusco, P. Zambarbieri, C. Zoschg, *Carlo Gavazzi Space S.p.A., Italy*
- 2:40 4. Efficient Algorithm for Performing Orbital Celestial Navigation: F. Busse, *MIT Lincoln Laboratory*
- 3:10 5. Evaluation Test on Prototype Local Remote-sensing System by GPS: S. Okuda, *Marine Technical College, Japan*; C. Jian, *Kobe University, Japan*; Y. Arai, *Marine Technical College, Japan*
- 3:40 6. A Primary Research and Practice to Determine Tide Height using PPP and Satellite Altimeter: X. Luo, J. Gao, X. Jin, Z. Wu, *Second Institute of Oceanography, China*

Alternate

1. Performance Analysis of Onboard Orbit Determination Using GPS at GEO for GOES-R: W.A. Bamford, D.E. Gaylor, *Emergent Space Technologies*



Dr. Suneel Sheikh, *ASTER Labs, Inc*



James Simpson,  
*NASA, Goddard Space Flight Center*

# Wednesday Afternoon, January 27



Dr. Letizia Lo Presti,  
*Politecnico di Torino, Italy*



Dr. José-Ángel Ávila-Rodríguez,  
*University FAF Munich, Germany*



Dr. Oleg Mezentsev,  
*i-Sense LLC, Russia*



Dr. Christophe Macabiau,  
*ENAC, France*



Dr. Michael Tran,  
*The MITRE Corporation*

## Session C5a: Algorithms & Methods II

1:00 p.m. – 2:35 p.m., Kon Tiki Ballroom

- 1:05 1. Performance Analysis on Pseudo Ranging Precision of Truncated P Code in CAPS: M. Wang, G.-Y. Ma, *Chinese Academy of Sciences, China*
- 1:35 2. An Efficient Matrix Inversion Algorithm for Navigation Applications: D. Hsu, *ITT Communications Systems Division*
- 2:05 3. Improving Indoor Positioning Accuracy Through a Wi-Fi Handover Algorithm: F. Alshely, R. M. Sabri, T. Arslan, Z. Sevak, *The University of Edinburgh, UK*

### Alternates

1. A New Method for Airborne Ionospheric Storm Detection Using Adaptive CCD & Relative RAIM: J.-M. Joo, M.-B. Heo, *Korea Aerospace Research Institute, South Korea*
2. Flight Test Results and Multipath Mitigation for Ionosphere-Free, Dual-Frequency Code Noise and Multipath (CNMP) Algorithm on King Air and DC-3 Airframes: D. Bruckner, F. van Graas, T. Skidmore, *Ohio University*

## Session C5b: Land Based Applications

2:35 p.m. – 4:10 p.m., Kon Tiki Ballroom

- 2:40 1. Cooperative Simultaneous Localization and Mapping in GPS-Denied Environments: A. Soloviev, *University of Florida*; P. Norris, *Air Force Research Laboratory*; C. Yang, *Sigtem Technology*
- 3:10 2. Self-calibration for IMU/Odometer Land Navigation: Simulation and Test Results: Y. Wu, *University of Calgary, Canada/National University of Defense Technology, China*; C. Goodall, N. El-Sheimy, *University of Calgary, Canada*

## Session D5: Galileo & GPS/Galileo

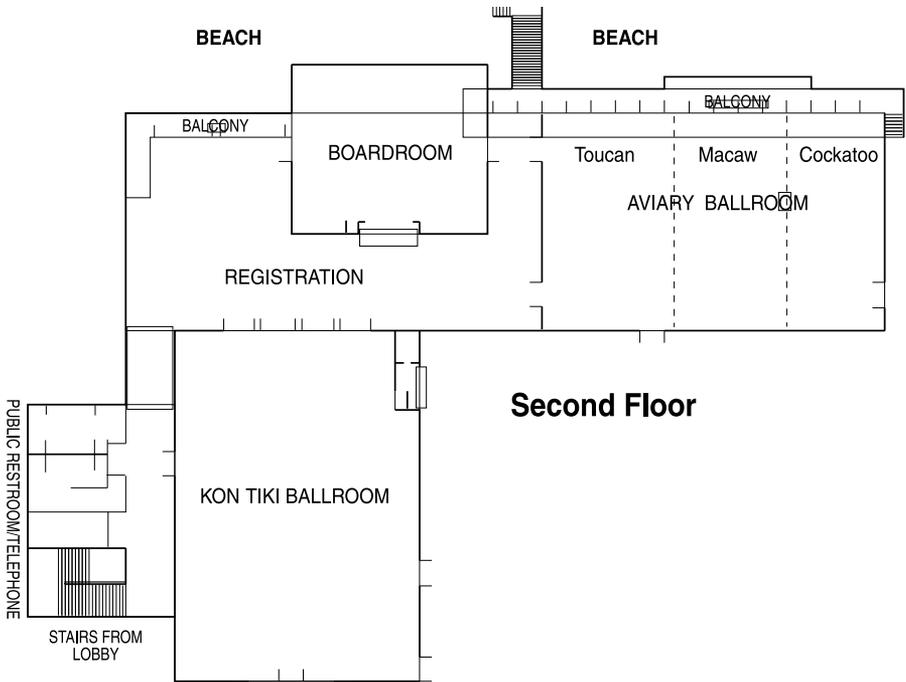
1:00 p.m. – 4:10 p.m., Cockatoo

- 1:05 1. On Multiplex Techniques for Satellite Navigation: Constant versus Non-Constant Envelope: J.-A. Ávila-Rodríguez, *University FAF Munich, Germany*; A.R. Pratt, *QinetiQ Ltd., UK*; S. Wallner, *University FAF Munich, Germany*; G.W. Hein, *European Space Agency, ESTEC, The Netherlands*; B. Eissfeller, *University FAF Munich, Germany*
- 1:35 2. Performance Assessment of GNSS Signals in Terms of Time to First Fix for Cold, Warm and Hot Start: M. Paonni, M. Anghileri, J.-A. Ávila-Rodríguez, S. Wallner, B. Eissfeller, *Institute of Geodesy and Navigation, University FAF Munich, Germany*
- 2:05 3. Estimation of Satellite and Receiver Phase and Code Biases with Multiple Galileo Frequencies: P. Henkel, *Technical University of Munich, Germany*; C. Günther, *Technical University of Munich and German Aerospace Center (DLR), Germany*
- 2:40 4. N-Gen: A Complete GPS and Galileo Software Suite for Precise Navigation: M. Fantino, A. Molino, *Istituto Superiore Mario Boella, Italy*; M. Nicola, *Politecnico di Torino, Italy*
- 3:10 5. Visibility and Geometry of Combined Constellations GPS with Health in Question, GLONASS and Galileo: J. Januszewski, *Gdynia Maritime University, Poland*
- 3:40 6. Efficient Design of Thread-Based Real-time Software GNSS Receiver in Multi-core System: Y.-S. Kim, G.-I. Jee, *Konkuk University, South Korea*



# The Institute of Navigation 2010 International Technical Meeting January 25-27, 2010

Catamaran Resort Hotel • San Diego, California



## Special Events

**Monday, January 25**

### INFORMAL LUNCHEON

On the Beach, Bayside North  
Noon – 1:00 p.m.

(Included in the price of a FULL registration. See Registration Form for ticket prices for single day registrants and guests.) In case of inclement weather, this function will be held in the Rousseau Suite (1st floor).

**Tuesday, January 26**

### ION ANNUAL AWARDS & FELLOWS BANQUET

Toucan/Macaw

6:30 p.m. – 7:00 p.m., Cash Bar  
7:00 p.m. – 9:00 p.m., Dinner & Program

(Included in the price of a FULL registration. See Registration Form for ticket prices for single day registrants and guests.)

*Dessert compliments of*

***NORTHROP GRUMMAN***

**Wednesday, January 27**

### INFORMAL LUNCHEON

On the Beach, Bayside North  
Noon – 1:00 p.m.

(Included in the price of a FULL registration. See Registration Form for ticket prices for single day registrants and guests.) In case of inclement weather, this function will be held in the Rousseau Suite (1st floor).